

THE ROLE OF INNOVATION IN ECONOMIC GROWTH, AND WHY ITS IMPACT IS LIMITED IN MANY PLACES

This is an era in which much of the public reverses innovations, especially in technology. For economists, innovation is always near the heart of economic growth and development. Since the health and stability of pension plans and systems also depend on economic growth, innovation is a matter of real import to those who manage, regulate or simply depend on those plans.

In broad economic terms, innovations are new ideas about how to combine and use labor and capital. While new ideas with commercial appeal can make their originators wealthy, most of the economic benefits of most innovations are enjoyed by those who use them. The benefits to businesses and their workers from using Windows, for example, far exceed Microsoft's profits, and heart medications provide greater benefits to those who use them and to their societies than the profits earned by the pharmaceutical makers that develop them.

That tells us that a society's openness to innovation is more important economically than, for example, the depth and range of its natural resources.¹ From 1960 to 2000, economic output and incomes grew more than three times faster in South Korea, with

few natural resources, than in Brazil, where those resources are abundant.² Much of the difference can be traced to Korea's openness to technological and other innovations developed elsewhere and imported to Korea through foreign direct investment or licensing agreements, as well as to Korea's commitment to the education that prepared its workers to work with new technologies and adapt to new ways of doing business.³

INNOVATION AS CATALYST FOR GROWTH

Since the 1950s, economists have documented the role that innovation has played in the economic growth and progress of the United States, the world's most successful advanced economy. Starting with Nobel laureate Robert Solow, researchers have established that the development and adoption of economic innovations has a much greater effect on America's underlying rate of growth and productivity than, for example, increases in physical capital (assets). They estimate that 30 percent to 40 percent of the gains in productivity and growth achieved from 1900 to the 1980s can be traced to economic innovation in its various forms, compared to 10 percent to 15 percent for increase in the capital stock⁴. These innovations encompass the development of not only new technologies, but also new materials and processes, new ways of financing, marketing and distributing



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INNOVATION ET CROISSANCE AMÉRICAINE

Robert J. Shapiro, expert américain de renom, principal conseiller économique du Président Clinton lors de la campagne de 1992, et conseiller spécial du Président Obama pour la campagne de 2008, traite dans cet article des conditions économiques et politiques permettant de mettre en place une réelle politique d'innovation. Il explique aussi comment la compétition est propice à l'innovation et quels sont les liens entre la fiscalité et l'innovation, la formation et l'innovation.

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goods and services, and new ways of managing a workplace and organizing a business.

Innovation thrives in places where commitments to research and development are strong, the political and economic environments are stable, barriers to starting new businesses are low, and intellectual property rights are respected. As a result, most economically-powerful innovations originate in advanced economies. Similarly, the most successful developing economies have been those that promote the economic and political conditions that support the adoption of innovations. For example, a World Bank study of 92 countries over the period 1960 to 2000 found that a 20 percent increase in the annual number of new patents granted, wherever the underlying technologies had originated, was associated with an increase of 3.8 percent in output.⁵

While intellectual property protections promote the development of innovations, their impact on the overall productivity of an economy depends on how broadly and effectively the country's businesses and households adopt and use those innovations. Such broad adoption can take many years.⁶ Jet engine travel, for example, spread slowly, because the early jetliners offered travelers only modest advantages compared to prop airplane travel. The adoption of an innovation also

involves significant costs, which may include new training and organizational changes as well as the price of new technologies.

THE LINK BETWEEN INNOVATION AND COMPETITION

Many factors can contribute to why it can take many years for some innovations to achieve broad acceptance and even longer to produce the productivity benefits ultimately associated with them. These factors

include, to begin, the price, the "knowledge set" of its potential users, investments in the existing goods or services which the innovation would displace, and the organizational changes and disruptions associated with its effective use. The adoption of DNA sequencing, for example, has been limited by the extensive education and training required to use it. Similarly, the adoption of alternative fuels has been slowed by the potential costs associated with writing down and replacing plant and equipment that use current forms of energy. And the productivity gains associated with information technologies were delayed by the extensive changes in business organization required for their effective use.

Given these various impediments, the principal force that drives the broad adoption and use of innovations in business is the strength of competition. A recent study from the Federal Reserve Bank of New York demonstrated this relationship. The researchers analyzed the pace and extent to which various PC manufacturers, competing with each other, incorporated new technologies and capacities in their machines. They compared results to Apple, which maintains an effective monopoly on its form of the personal computer. They found that competition drove the PC makers to introduce more new products, with shorter life spans and fas-

ter-falling prices, than Apple.⁷ To be sure, competition in the PC market may be especially powerful in driving innovation, because the introduction of a new model is usually accompanied by sharp price cuts for earlier models. Apple has largely shielded itself from this competition. In part, as a consequence, Apple introduces fewer new models with new capacities than PC makers, maintains longer product cycles, and offers smaller price discounts.

Competition also drives innovations across borders – from businesses in one country to business in another – especially among the advanced economies. One analysis of this diffusion process found that between 49 percent and 87 percent of the differences in the rates of adoption across countries can be explained by the relative advantage the innovation confers in competition, its compatibility with existing technologies and organizational arrangements, and its complexity.⁸ The diffusion of innovations to companies in developing nations, however, is more sensitive to other factors, including the nation's wealth, the quality of its workforce, its openness to trade, and whether it has adopted predecessor innovations.

How people perceive or understand an innovation and the advantages it offers can also be a critical factor in its spread within an economy and across

borders. For example, the use of seatbelts accelerated once it was perceived clearly that the new technology saved lives. An innovation's compatibility with existing arrangements can have large effects, so that farmers in developing nations were slow to adopt techniques of soil conservation, because those techniques were seen to conflict with traditional values of expanding farm production. The importance of an innovation's complexity is evident in the adoption of computers, which began with small numbers of early adopters and spread across the U.S. and other advanced economies, and eventually developing economies, only after additional innovations made computers user-friendly.

THE ROLE OF REGULATION AND FISCAL CONDITIONS

Other factors can interfere with the spread of innovations from one country to another, especially legal and regulatory arrangements which dampen competition and so impede the normal process by which innovations generally are adopted. For example, barriers to the formation of new businesses can dampen the competitive pressures to innovate: New firms are more likely to seize on innovations; and if they help them claim a share of the market, that success produces new competitive pressures for others to adopt the same innovations. Product price regulations also can interfere with the market dynamics which

drive down the prices of many innovations. Similarly, trade protections may shield firms from competition with innovative companies in other countries. Finally, certain labor regulations may prevent companies from undertaking the organizational changes required to make effective use of innovations.

While I have studied and thought about innovation as an economic phenomenon for many years, I also confronted its requirements several times while advising public officials. As the principal economic advisor to Bill Clinton when he ran for U.S. president in 1991-1992, I found myself arguing with his political advisors over the importance of restoring sound fiscal conditions. The argument that captured the attention of the then-candidate and soon-to-be president was not only that he had to assure the bond markets that deficits were under control, in order to promote the lower long-term interest rates that would accelerate business investment. Beyond that, I insisted, much of the new business investment would focus on innovative, new information technologies, and in that lay his best chance to help average people increase their incomes. Later, as his Under Secretary of Commerce for Economic Affairs, I helped oversee what became the longest and most productive expansion in American history, driven mainly by the broad application of these and other innovations.

Much more recently, as an economic advisor to the 2008 campaign and transition of Barack Obama, I put together a plan to focus part of the coming stimulus program on innovation, from clean energy to health care. Much of it survived in the stimulus program of 2009-2010; and we will have to wait and see if those investments will help drive higher productivity and growth in future years.

There was nothing unique about these approaches. Any nation and society intent on driving up its productivity and growth must give careful attention to the factors that drive and otherwise affect innovation. At stake is the path of future incomes as well as the financial health of its pension plans and those who depend on them. Such attention will include not only explicit support through strict intellectual property protections and funding for basic research. It also encompasses efforts to ensure an economic and political environment that will be conducive to innovation by encouraging business formation, competition, and adaptability. ■

(1) This discussion is adapted from Robert J. Shapiro and Kevin A. Hassett, "The Economic Value of Intellectual Property," 2005, <http://www.sonecon.com/docs/studies/IntellectualPropertyReport-October2005.pdf>.

(2) World Bank, *World Development Indicators*, Washington, DC: World Bank, 2005.

(3) Shapiro and Hassett (2005), *op. cit.*

(4) Robert M. Solow, "A Contribution to the Theory of Economic Growth," *Quarterly Journal of Economics*, Vol. 70, 1956; Robert M. Solow, "Technological Change and the Aggregate Production Function," *Review of Economics and Statistics*, Vol. 39, No. 3, 1957; Edward F. Denison, "The Sources of Economic Growth in the United States and the Alternatives Before Us," *Committee for Economic Development, Supplementary Paper Number 13*, 1962.

(5) Derek H.C. Chen and Carl Dahlman, "Knowledge and Development: A Cross-Section Approach," *World Bank Policy Research Working Paper No. 3366*, November 2004.

(6) See, for example, Bronwyn H. Hall, "Innovation and Diffusion," *NBER Working Paper, National Bureau of Economic Research*, 2004.

(7) Adam Copeland and Adam H. Shapiro, "The Impact of Competition on Technology Adoption: An Apples-to-PCs Analysis," *Staff Report No. 462*, Federal Reserve Bank of New York, 2010.

(8) Everett Rogers, *Diffusion of Innovations*, Free Press, 2003. The other two factors are "trialability," or the extent to which the innovation can be experimented with on a limited basis, and "observability," the degree to which the results of an innovation are visible to others.